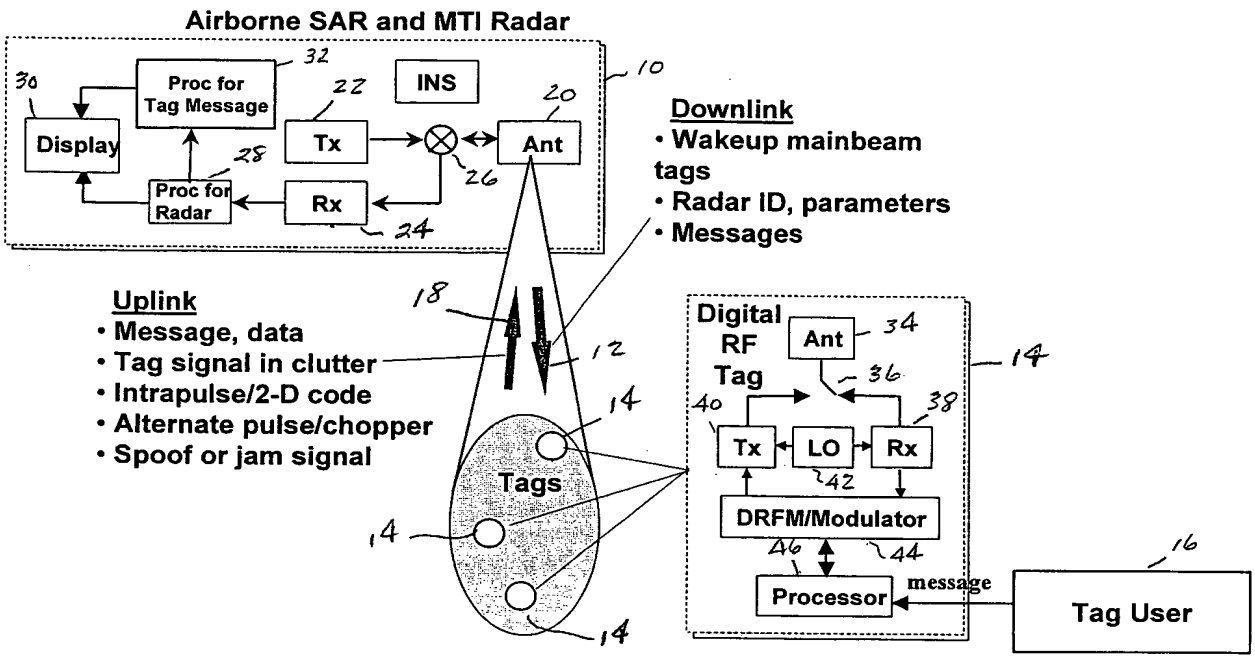
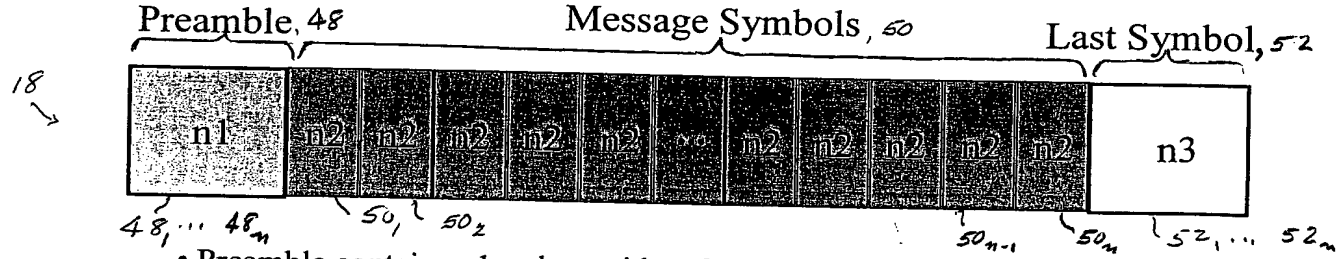


FIG. 1

- Message Symbols are in base Ns = 3



- Preamble contains n1 pulses with sufficient SNR to make initial detection.
- Message Symbols each contain n2 pulses.
- Last Symbol contains n3 pulses for enough SNR to make final detection.

FIG. 2

BEST AVAILABLE COPY

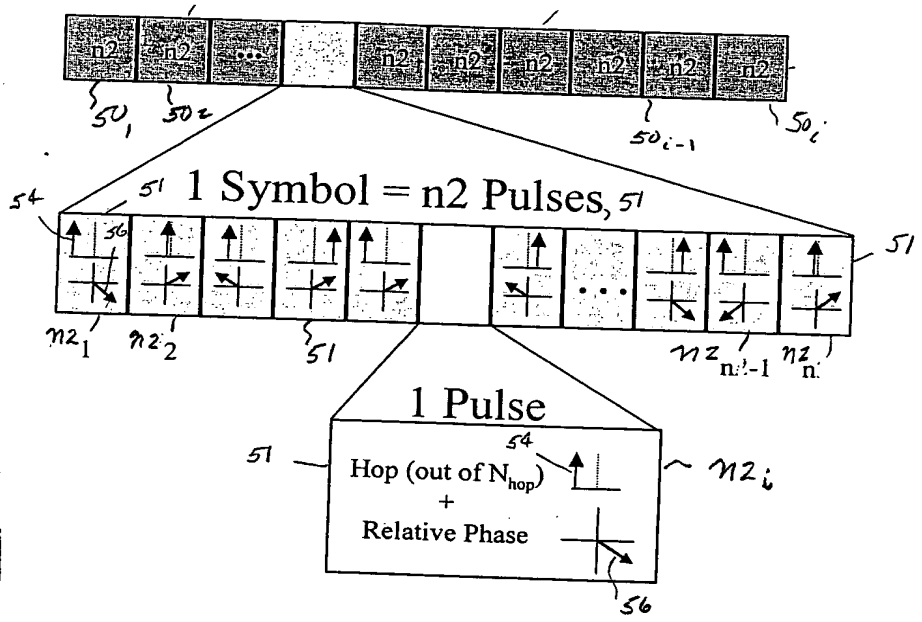


FIG. 3

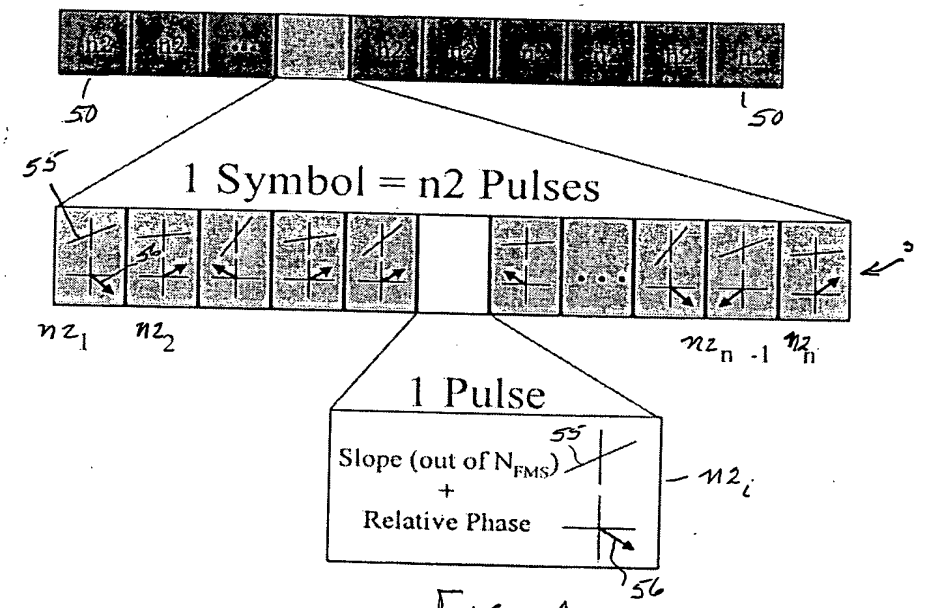


FIG. 4
(RELATED ART)

BEST AVAILABLE COPY

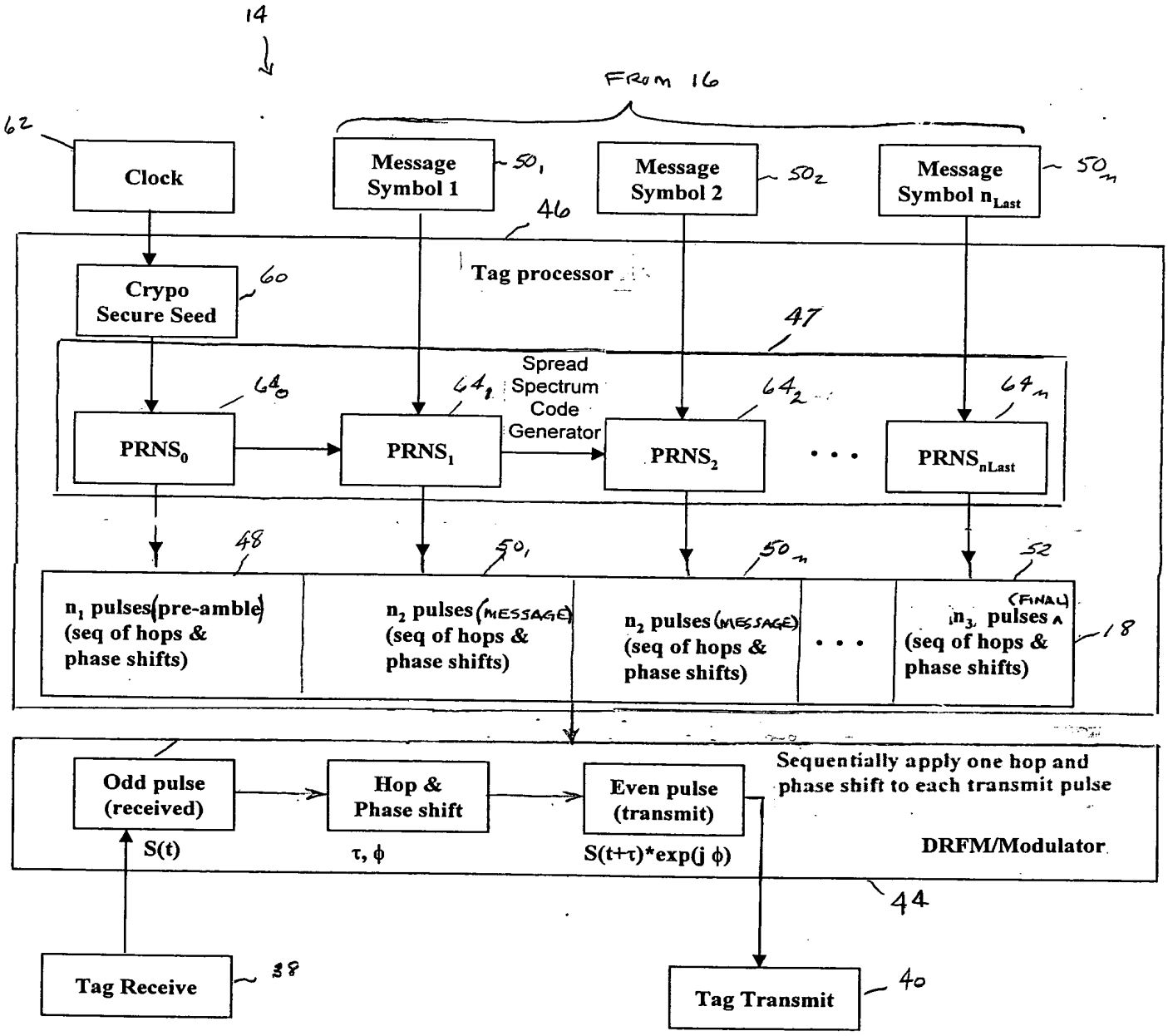

14
From 16
62
Clock
Message Symbol 1
50₁
Message Symbol 2
50₂
Message Symbol n_Last
50_m
46
Tag processor
Crypo Secure Seed
60
47
Spread Spectrum Code Generator
64₀
64₁
64₂
64_m
PRNS₀
PRNS₁
PRNS₂
PRNS_nLast
48
50₁
50_m
52
n₁ pulses (pre-amble) (seq of hops & phase shifts)
n₂ pulses (MESSAGE) (seq of hops & phase shifts)
n₂ pulses (MESSAGE) (seq of hops & phase shifts)
n₃ pulses (FINAL) (seq of hops & phase shifts)
18
Odd pulse (received)
Hop & Phase shift
Even pulse (transmit)
Sequentially apply one hop and phase shift to each transmit pulse
S(t)
τ, ϕ
S(t+τ)*exp(j ϕ)
DRFM/Modulator
44
Tag Receive
38
Tag Transmit
40

FIG. 5

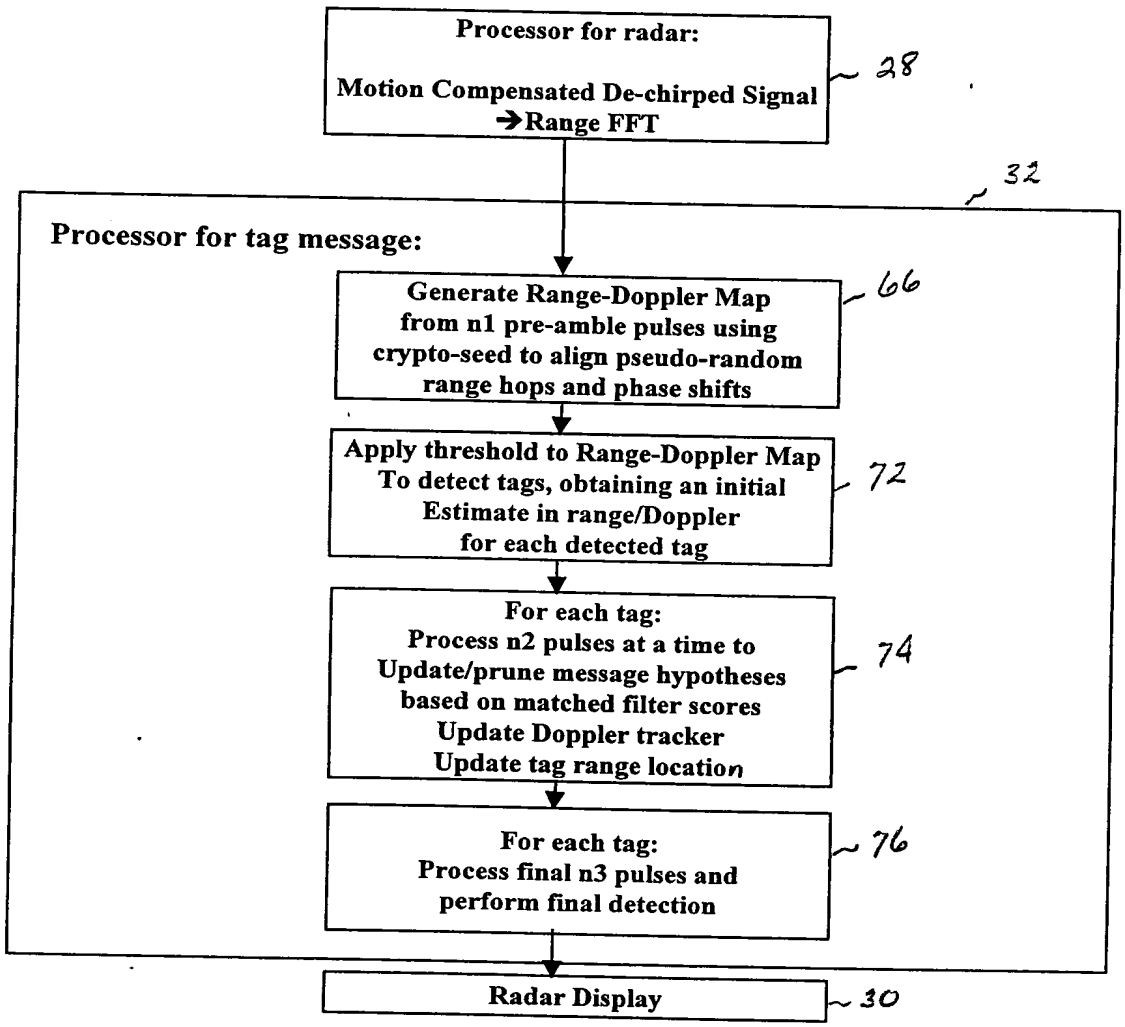

Processor for radar:
Motion Compensated De-chirped Signal
→Range FFT
28
32
Processor for tag message:
Generate Range-Doppler Map
from n1 pre-amble pulses using
crypto-seed to align pseudo-random
range hops and phase shifts
66
Apply threshold to Range-Doppler Map
To detect tags, obtaining an initial
Estimate in range/Doppler
for each detected tag
72
For each tag:
Process n2 pulses at a time to
Update/prune message hypotheses
based on matched filter scores
Update Doppler tracker
Update tag range location
74
For each tag:
Process final n3 pulses and
perform final detection
76
Radar Display
30

FIG. 6

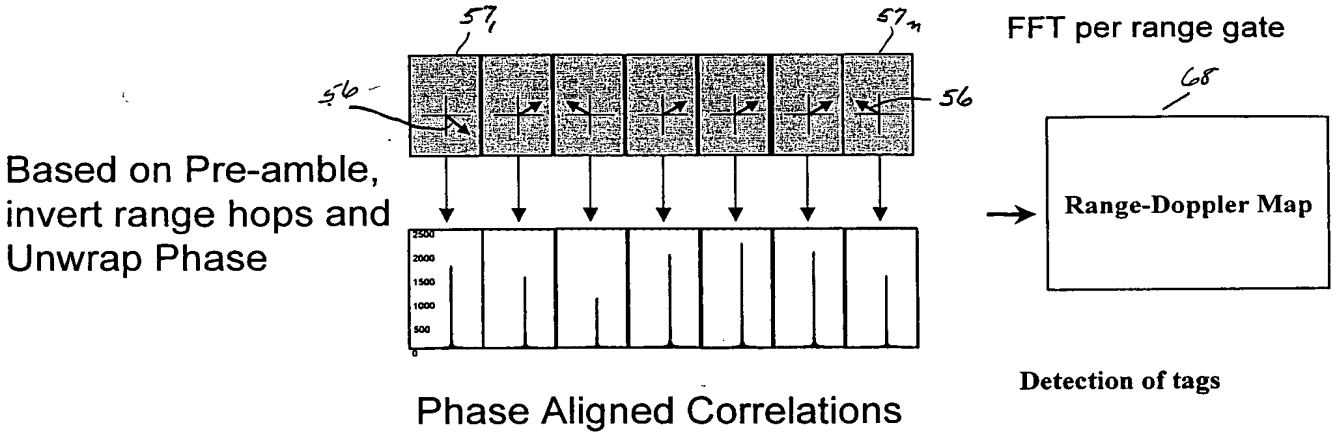

Based on Pre-amble, invert range hops and Unwrap Phase
57₁
57ₘ
56
56
2500
2000
1500
1000
500
0
Phase Aligned Correlations
FFT per range gate
68
Range-Doppler Map
Detection of tags

Fig. 7

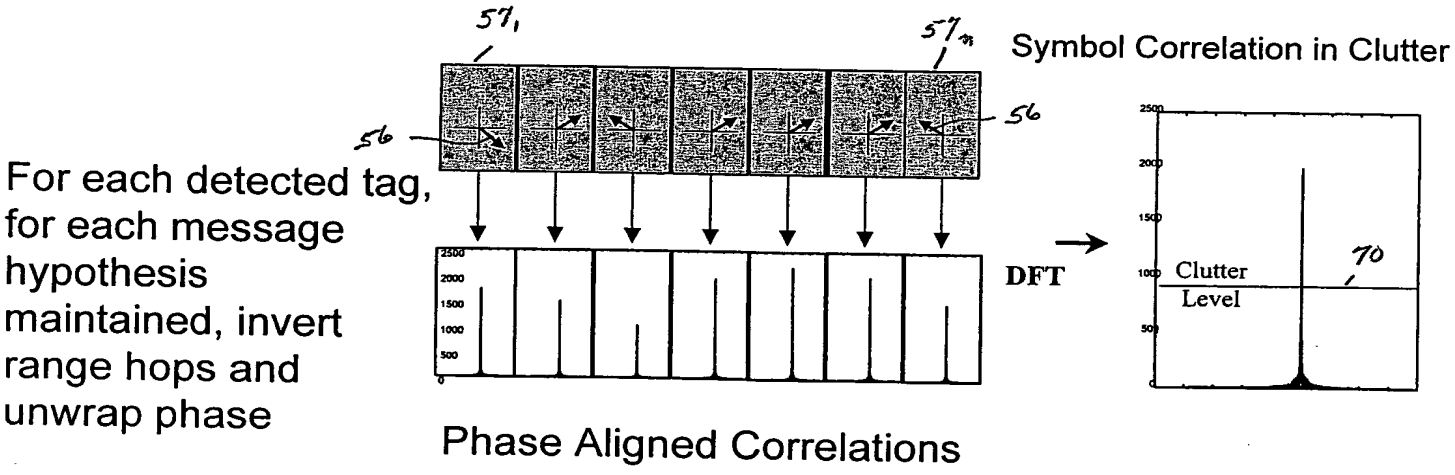
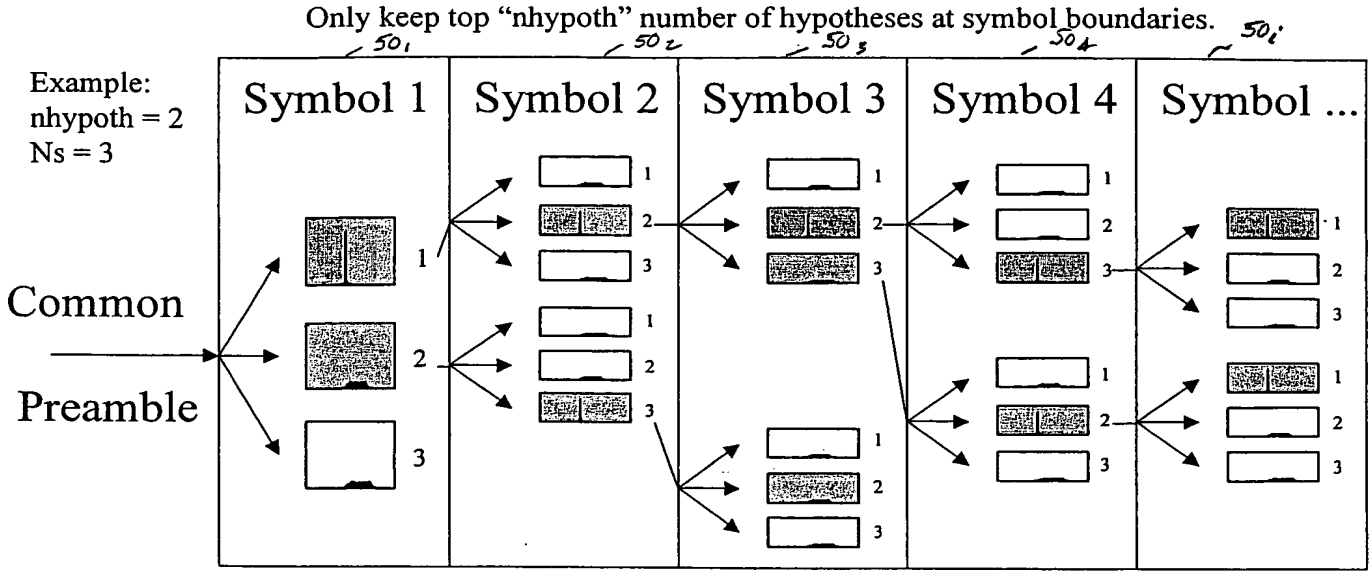

For each detected tag, for each message hypothesis maintained, invert range hops and unwrap phase
57₁
57ₘ
56
56
2500
2000
1500
1000
500
0
Phase Aligned Correlations
Symbol Correlation in Clutter
DFT
2500
2000
1500
1000
500
0
Clutter Level
70

Fig. 8



At each symbol boundary, only keep the 2 hypotheses (paths) with the highest "scores".

FIG. 9A

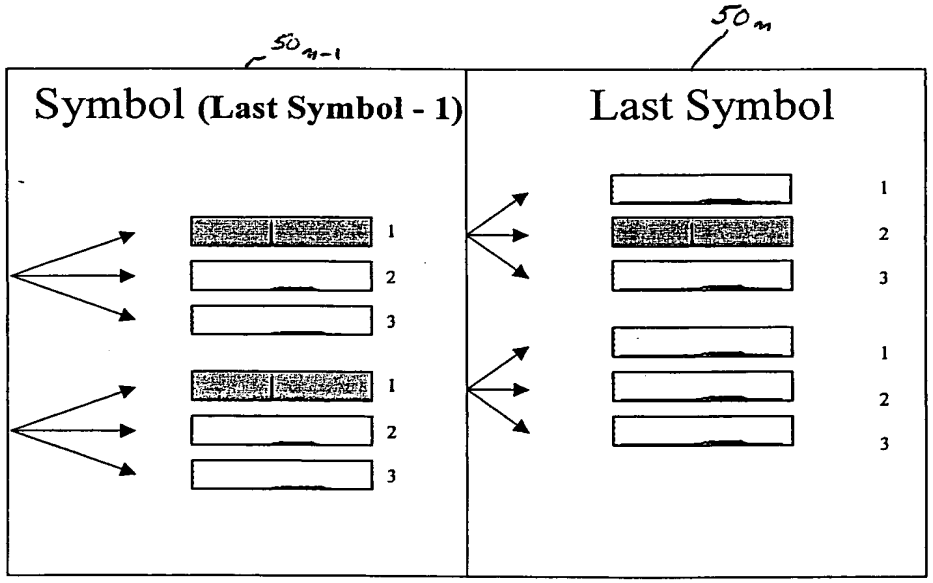


FIG. 9B